THE ASIATIC CLAM (*CORBICULA*) IN ILLINOIS

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ABSTRACT. — Specimens of the introduced Asiatic clam (*Corbicula*) were obtained at 18 collection stations located in the Ohio, lower Wabash and Mississippi rivers bordering southern and eastern Illinois. This clam has now (1964) become established throughout the lower Ohio River and has ascended the Wabash River as far as White County, Illinois. No specimens were found in the Mississippi River above Cairo. Rapid dispersion and population growth of this introduced mollusk in Illinois waters have occurred within the past four or five years.

The introduced Asiatic clam was first observed in the United States in 1938 in California (Dundee and Dundee, 1958); between 1938 and 1963 this mollusk had spread to at least five other western states. Sinclair and Ingram (1961) reported *Corbicula* from the Tennessee River (Hardin County, Tennessee), the first occurrence of the Asiatic clam east of the Mississippi River. Since their report (op. cit.), this clam has also been recorded in eastern United States from Florida (Heard, 1964), Louisiana (Dundee and Harman, 1963), Alabama (Hubricht, 1963), Ohio (Keup, Horning and Ingram, 1963), West Virginia (Thomas and Mackenthun, 1964), Kentucky (Sinclair and Isom, 1961) and Illinois (Fechtner, 1962). The Kentucky and Illinois records are based on specimens of *Corbicula* taken from the Ohio River just east of Metropolis on the Illinois side and at the Shawnee Steam Plant, about two miles down river from Metropolis on the Kentucky side. Sinclair and Isom (1963) state that "All specimens examined from the Ohio River Basin belong to one species based on sexuality and life history, and are placed in the synonomy of *C. manilensis* together with *C. leana*, *C. javanica*, and *C. vicina*."

The rapid dispersion and population growth of this clam are not fully understood. Possible means of dispersal such as their inclusion in sand and gravel dredged from one area and deposited in another (for example, by barge), accidental transportation by water birds (ducks swallowing small clams and passing an occasional individual through the digestive tract unharmed), and transporting and eventual discarding of clams by tourists, fishermen (using them as bait) or aquarium hobbyists have been suggested by Ingram, Keup and Henderson (1964) and others. It is quite possible that mollusk-feeding fish such as the freshwater drum (*Aplodinotus grunniens*) may be an important factor in the dispersal of this clam within a given river system. Sinclair and Ingram (1961) stated that "One can only speculate as to the mode of transportation of this native of Asia; however, a likely theory would first incriminate the dumping of aquaria and fish bowls that contained introduced 'aquaria rarities.'"

DESCRIPTION OF *CORBICULA*

The Asiatic clam is a bivalve mollusk (Fig. 1) belonging to the Class Pelecypoda, Order Heterodonta and Family Corbiculidae. Sinclair and Isom (1963) report the largest Tennessee River forms taken were 43 mm in length, although *Corbicula* in Western United States measured 55 mm and native forms from Formosa and China, 83 mm. There is considerable variation in the general shape of the adult shell and there occurs a change in shape of the individual clam from the juvenile to the adult stage. Sinclair and Isom (1961) describe the shell as ovate (young) to trigonal (mature) in shape, inflated at the umbones, heavy, sculptured with concentric rings and covered with a lustrous yellow-green periostracum. There are three cardinal teeth in each valve, two lateral teeth on each side in the right valve and one on each side in the left valve. Umbones of typical mature individuals are eroded.

Immature clams (1 mm or less in length) are cream colored and without pattern; by the time individuals reach 5 mm, shells take on the polished tan periostracum of the adult and by 8 mm the periostracum becomes olive in color and highly polished (Sinclair and Isom, 1961). Mature shells gradually darken from a

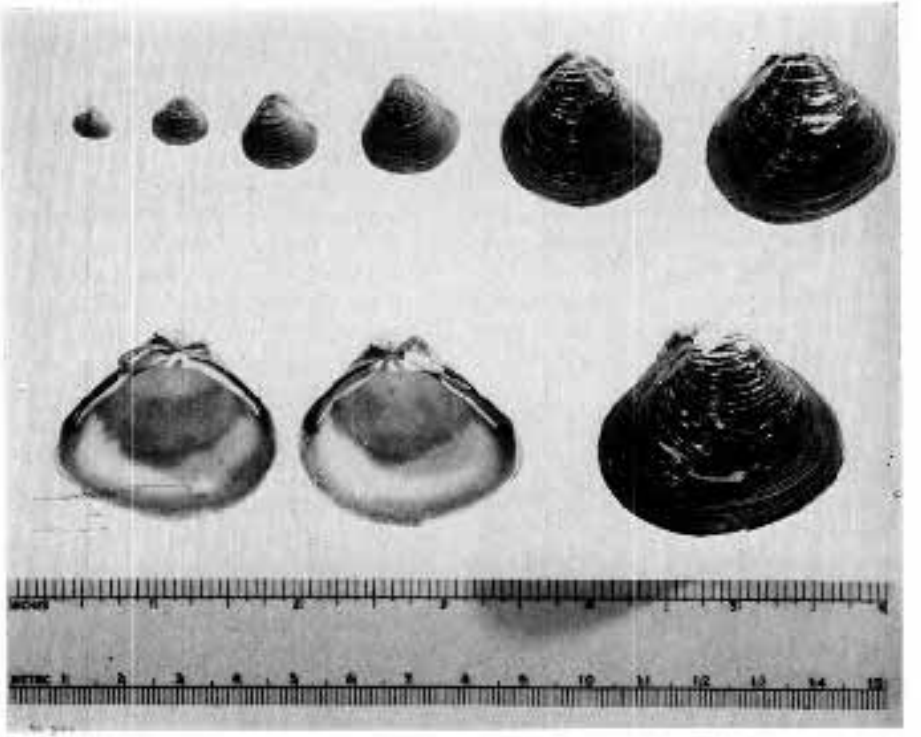

Figure 1.— Specimens of the Asiatic clam (*Corbicula*) from the Ohio River, Illinois.

brownish black to jet black. Very young specimens possess a characteristic dark stripe on the anterior central part of the valves and more narrow, less distinct stripes on the posterior margins. The inner margins of the shell are a deep purple color while the entire inner surface of adults is whitish or a very light purple.

Sinclair and Isom (1961) state that *Corbicula* from the Tennessee River reaches sexual maturity during the first year at a length of 6.5 mm, and that the spawning season extends from at least July to November. Fertilized eggs of the clam develop in the inner demibranchs of the adult and the microscopic planktotrophic larvae are released by the thousands. Unlike most fresh-water naiads which pass through a stage of parasitic (glochidia) development on the gills or fins of fish, the veliger larvae of *Corbicula* begin a free-living existence on the bottom soon after being released into the water from the adult. During this study, *Corbicula* reached its greatest size and local abundance (Ohio River at Old Shawneetown) on a substratum of predominantly sand mixed with, or overlaying, mud in 1 to 2 feet of water.

CORBICULA IN ILLINOIS

During an August, 1964 field trip made by the author for the purpose of collecting fresh-water mussels in the lower Wabash River (White County, Illinois), two old valves of the Asiatic clam were found in a section of that river referred to as "little chains." These shells were sent to Ralph M. Sinclair, Principal Biologist, Stream Pollution Control, Department of Public Health, Nashville, Tennessee, who identified them as *Corbicula* cf. *manillensis*. I would like to express my sincere appreciation to Mr. Sinclair for this determination, for comparative material from the Tennessee River system and for his many helpful suggestions.

Keup, Horning and Ingram (1963) state that, based on a study by Jackson and Wise, "Asiatic clams were not found in benthic samples collected as late as January, 1960, from the Ohio River, from Pittsburgh, Pennsylvania, downstream to Mound City, Illinois." Since the only published record (Fechtner, 1962) for the occurrence of the Asiatic clam in Illinois was based on eleven recently dead specimens found in 6 inches of water east of Metropolis (Ohio River, Massac County), the recovery of *Corbicula* from the lower Wabash River suggested a possible rapid dispersal of this clam in Illinois waters during the last two or three years.

In order to determine the range extension of *Corbicula* in the major rivers bordering southern and eastern Illinois, collection stations (Mississippi River, 4; Ohio River, 8; Wabash River, 5) were established (Fig. 2) and shorelines varying from several hundred yards to 1½ miles were examined for the presence of this clam. A bottom sampler, consisting of a triangular-shaped, brass screened "basket" (1/16 inch mesh), 10 inches wide at the base, 17 inches long and covered with a hinged, wire (1 x 2 inch square) lid was used to remove and sift the substratum. The "basket" was welded to a shovel handle and this tool proved extremely

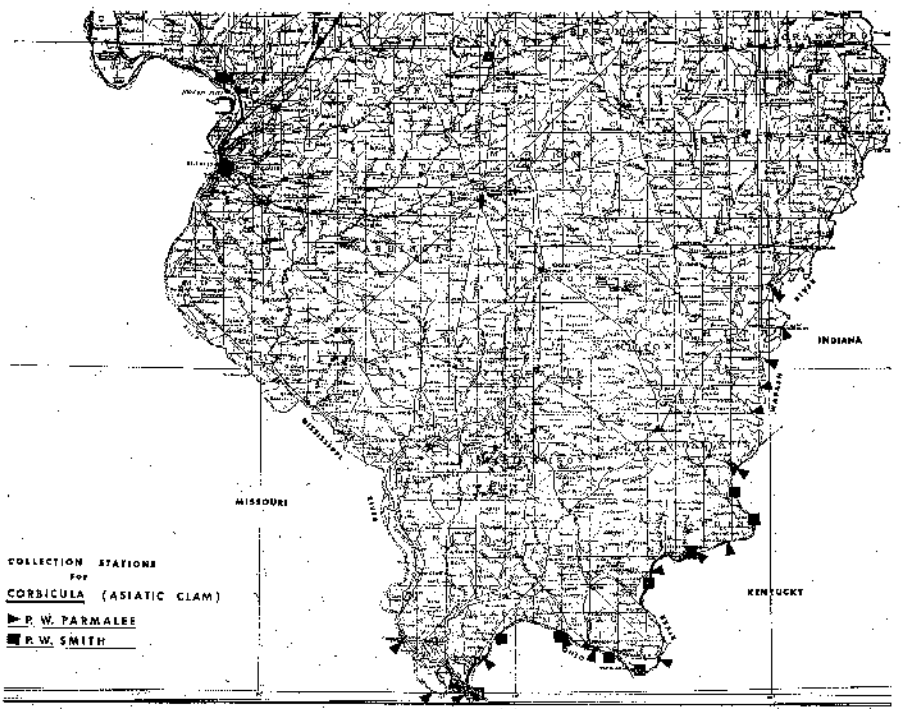

Figure 2.— Collection Stations Examined for the Presence of *Corbicula*, August and September, 1964.

efficient in obtaining living specimens.

This survey was undertaken on September 8, 9, and 10, 1964. In addition to the collection stations visited by the author (triangular symbols), *Corbicula* was obtained at eight other localities (square symbols, Fig. 2) on the Ohio River by personnel from the Illinois Natural History Survey and the Illinois Department of Conservation for Dr. Philip W. Smith. Sample collections of the Asiatic clam were saved for the author by Dr. Smith and his associates during their fish survey work, also on the above mentioned dates, and I would like to express my gratitude for their records.

Live specimens of *Corbicula* were taken at all stations on the Ohio River, thus establishing this introduced clam as an inhabitant throughout the entire length of the Ohio River bordering Illinois. Specimens taken on the Kentucky side of the river (confluence of the Ohio and Mississippi rivers at Cairo, and opposite Olmsted and Joppa, Illinois) by Philip W. Smith and his associates also suggest complete establishment of *Corbicula* along both shores. Of the 15 stations on the Ohio River, greatest population densities of the Asiatic clam were found at Mound City (Pulaski County), Ft. Massac State Park (Massac County) and at Old Shawneetown (Gallatin County).

The largest numbers (for unit of area) of adult *Corbicula* were encountered at Old Shawneetown. The animals were living in one to two feet of water on a substrate of sand and mud. Houseboats belonging to commercial fishermen were anchored at this locality and the waters around those boats were foul from the fish offal that was continually being thrown overboard. Such conditions probably favor the development of phytoplankton, the principal food of this clam, and it appeared that a larger number of individuals were attaining adult size (30 mm) within that local population.

Substrata at the other Ohio River stations varied from nearly pure sand to hardened clay and mud (Fort Defiance State Park at Cairo). Bottom conditions of the latter type are unfavorable for the establishment of *Corbicula* and clams were rare or absent in such habitats. The river was at low stage during this investigation and the greatest concentration of local Asiatic clam populations occurred in varying depths from six inches to two feet.

No specimens of *Corbicula* were encountered in the Mississippi River on the Illinois side at the four stations examined (Fig. 2). However, three dead valves (pairs) and one live immature specimen were found almost directly below the Illinois-Missouri bridge on the Missouri side of the river. Specimens obtained by Philip W. Smith and his associates along a sand bar in Kentucky directly across the Ohio River from Cairo (Ft. Defiance) and the few shells taken by the author in the Mississippi River on the Missouri shore establish the range of *Corbicula* south to the confluence of these rivers. Judging from its known fast rate of dispersal, the Asiatic clam can soon be expected to ascend the Mississippi River into local areas of suitable habitat.

Living specimens of the Asiatic clam were taken at two stations on the lower Wabash River. At the first station, a sand bar extending 1-1½ miles along the Illinois shore approximately 2 miles S.E. of New Haven, Gallatin County, numerous immatures and young adults were encountered in the shallow water, moist sand and pools left by the receding river. The largest specimen measured only 19 mm and this population was sparse compared with the dense local concentrations encountered at certain localities in the Ohio River. Shells were a polished olive-yellow in color and only the three largest specimens (17-19 mm) showed a beginning of the trigonal shape of the adult. These largest clams were probably 2-3 years of age, judging from age and length data given by Sinclair and Isom (1961). Using these same age criteria data, the Ohio River populations had been established for at least 3 years.

The second Wabash River station, 2 miles S. E. of Rising Sun, White County, is known locally as "little chains." Large broken slabs of limestone form the bank along the Illinois side for about ¾ of a mile and compose the river bed nearly to the Indiana side. This produces a rapids with swift current; the substratum consists of these large flat rock slabs, stones and coarse gravel mixed with some sand and mud. Only 3 old valves and one living young adult (2 years of age?) were found. Collect-

ing was difficult because of the type of substrate and it is possible a population of *Corbicula* is more extensive at this point than the few shells recovered would suggest.

However, no specimens of this clam, living or dead, were encountered in over a mile of sand beach at the next station (2 miles S. E. of Mannie) approximately 5 miles north of "little chains." Examination of sand bars at New Harmony, Indiana, and at Grayville, Illinois, failed to produce *Corbicula*. The confluence of the Ohio and Wabash rivers is about 12 river miles below the first Wabash River station where this clam was collected. It would appear that range extension of the Asiatic clam in Illinois occurs more rapidly in a downstream direction. Possibly populations of the Asiatic clam became established in the lower Ohio River as a result of individuals being carried downstream by current. Natural ascent of a river for a mollusk like the Asiatic clam would be expected to be slower than descent. Relatively sparse (young?) populations of *Corbicula* in the lower Wabash River versus a dense (old) populations in the Ohio River at Old Shawneetown, localities approximately equal distance from the confluence of these rivers, would suggest an upstream source (for example the Cincinnati area: Keup, Horning and Ingram, 1963) for the Ohio River populations in Illinois. Possibly severe winter conditions may limit the northward spread of this clam or its abundance in northern latitudes, as may have been the case in Ohio (Horning and Keup, 1964).

What impact the Asiatic clam will have on the biology of Illinois waters and related fauna, or on certain industries associated with the major waterways, remains to be seen. The nuisance aspects of *Corbicula* have been discussed by Sinclair and Isom (1961) and Sinclair (1963) — the clogging of intake and cooling water pipes at various steam plants and the contamination of sand and gravel deposits. On the beneficial side, this clam may prove to be of value as a food for numerous species of economically important fish and waterfowl.

Literature Cited

Dundee, D. S., and H. A. Dundee. 1958. Extensions of known ranges of 4 mollusks. Nautilus, 72 (2):51-53.

Dundee, D. S., and W. J. Harman. 1963. *Corbicula fluminea* (Muller) in Louisiana. Nautilus, 77(1):30.

Fechtner, F. K. 1962. *Corbicula fluminea* (Muller) from the Ohio river. Nautilus, 75(3):126.

Heard, W. H. 1964. *Corbicula fluminea* in Florida. Nautilus, 77(3):105-107.

Horning, W. B., and L. Keup. 1964. Decline of Asiastic clam in Ohio river. Nautilus, 78(1):29-30.

Hubricht, L. 1963. *Corbicula fluminea* in the Mobile river. Nautilus, 77(1): 31.

Ingram, W. M., L. Keup, and C. Henderson. 1964. Asiatic clams at Parker, Arizona. Nautilus, 77(4):121-124.

Keup, L., W. B. Horning, and W. M. Ingram. 1963. Extension of range of Asiatic clam to Cincinnati reach of the Ohio river. Nautilus, 77(1):18-21.

Sinclair, R. M., and W. M. Ingram. 1961. A new record for the Asiatic clam in the United States, the Tennessee river. Nautilus, 74(3):114-118.

Sinclair, R. M., and B. G. Isom. 1961. A preliminary report on the introduced Asiatic clam *Corbicula* in Tennessee. Tennessee Stream Pollution Control Board, Tennessee Department of Public Health, Nashville. 31 pp.

——— 1963. Further studies on the introduced Asiatic clam *Corbicula* in Tennessee. Tennessee Stream Pollution Control Board, Tennessee Department of Public Health, Nashville, 75 pp.

SINCLAIR, R. M. 1963. Effects of an introduced clam (*Corbicula*) on water quality in the Tennessee river valley. Tennessee Stream Pollution Control Board, Tennessee Department Public Health. 12 pp.

THOMAS, N. A., and K. M. MACKENTHUN. 1964. Asiatic clam infestation at Charleston, West Virginia. Nautilus, 78(1):28-29.

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